
Meridian 1 power systems

Meridian 1 features a modular power distribution architecture. As part of the modular design, the Meridian 1 power system provides:

- A power distribution unit located in the pedestal which functions as a distribution point for the input voltage (AC or DC) to each of the modules and protects them from current overload
- Power supplies located in each module, rather than in separate centralized power shelves
- A universal quick-connect power wiring harness, which carries the power and monitor signals to the power supplies in each module
- Modular backup capabilities on a per column basis

The terms “AC system” and “DC system” refer to the type of power brought into the pedestal and distributed within the system to the module power supplies. [Figures 1](#) and [3](#) show the basic power distribution for AC and DC systems. All system options (except option 21A) are available in both AC power and DC power versions. Option 21A is available with AC power only.

To understand the Meridian 1 power architecture, consider the distinction between the “internal” and “external” power components. Internal power components are those contained within the Meridian 1 itself that form an integral part of the Meridian 1 power subsystem. These include components such as the power distribution unit (PDU) in the pedestal, the power wiring harness, and the module power supplies.

Although the PDU and module power supplies differ in AC- and DC-powered systems, power distribution is similar: power is input to the pedestal and distributed to individual power supplies in each module. In AC-powered systems, the module power supplies convert the AC voltage to several usable DC voltages; in DC-powered systems, the module power supplies convert the DC voltage to several usable DC voltages.

Except for the power components and the power wiring harness, all other functional elements within the system (such as card cages, backplanes, circuit cards, and system monitor) are identical in both AC and DC systems.

External power components are those outside the Meridian 1 columns. If reserve power is not required, AC-powered systems have no external components; AC systems plug directly into the commercial AC power source. If an uninterrupted power supply (UPS) is installed for reserve power, it is considered an external power component. All DC systems are powered by rectifiers that are external to the system.

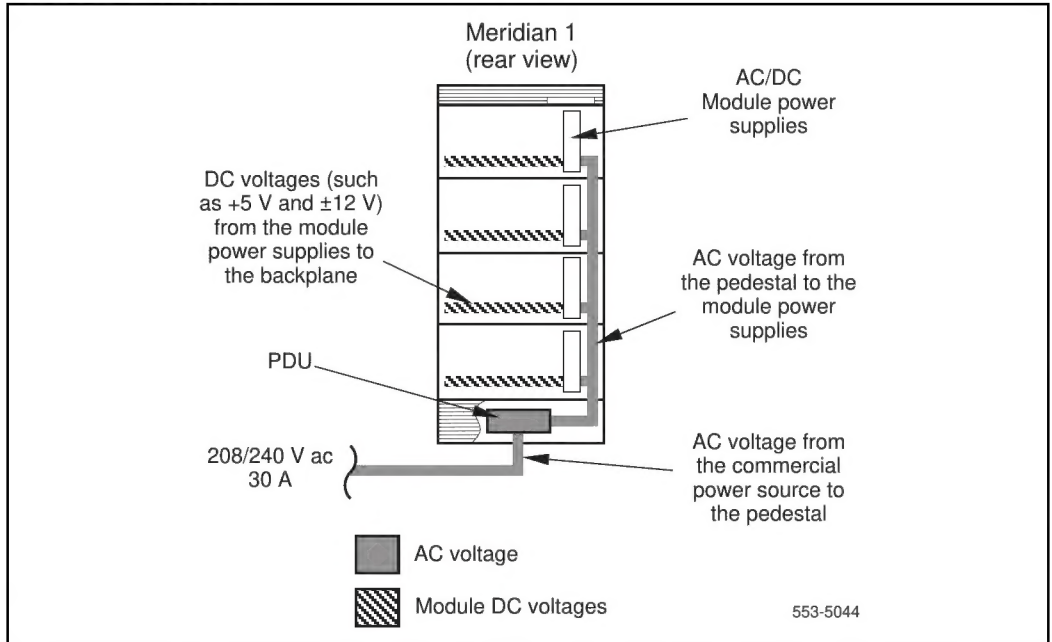
AC power

AC-powered systems require no external power components and can plug directly into the commercial utility power source (see [Figure 1](#)). AC powering requires a single conversion from the AC input voltage to the DC voltages required by the system. This conversion is performed by power supplies in each module.

AC-powered systems are well-suited for applications that do not require reserve power. They are also recommended for small-to-medium-sized (two columns or less) systems (system options 21 through 61) that require reserve power with backup times ranging from 15 minutes to 8 hours.

If reserve power is required with an AC-powered system, an uninterruptible power supply (UPS) is installed in series with the AC power source (see [Figure 2](#)). AC-powered systems that do not require long-term backup can benefit from a UPS with short-term backup. A UPS can provide power conditioning during normal operation, including protection against sags, brownouts, and other low-voltage transient conditions that cause most power disturbances.

Figure 1
AC-powered system

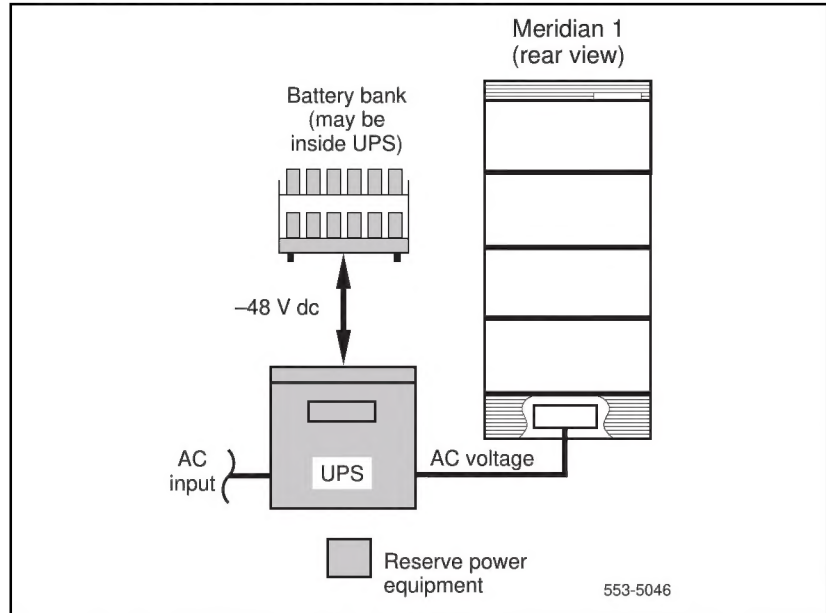


DC power

DC-powered systems require external rectifiers which connect directly to a commercial AC power source (see [Figure 3](#)). DC-powered systems require a double conversion: the rectifiers convert the AC voltage to -48 V dc which is distributed by the PDU in the pedestal to the power supplies in the modules. The power supplies convert -48 V dc to other DC voltages required in each module.

Batteries are generally used with DC-powered systems because the traditional method for powering telecommunications uses rectifiers to continuously charge a bank of batteries, while the system power “floats” in parallel with the battery voltage. However, batteries are only used if reserve power is needed. [Figure 4](#) shows a DC system with reserve power equipment.

Figure 2
AC-powered system with reserve power



Complete systems—including DC power plants—can be provided by Northern Telecom. Systems can also be configured to connect to an existing power plant provided by the customer.

DC systems should be considered for the following:

- Most large systems (either option 71, 81, or 81C or any system larger than two columns)
- Most systems with long-term reserve power requirements (usually eight hours or more)
- When the customer site has an existing DC power plant or batteries available

Figure 3
DC-powered system

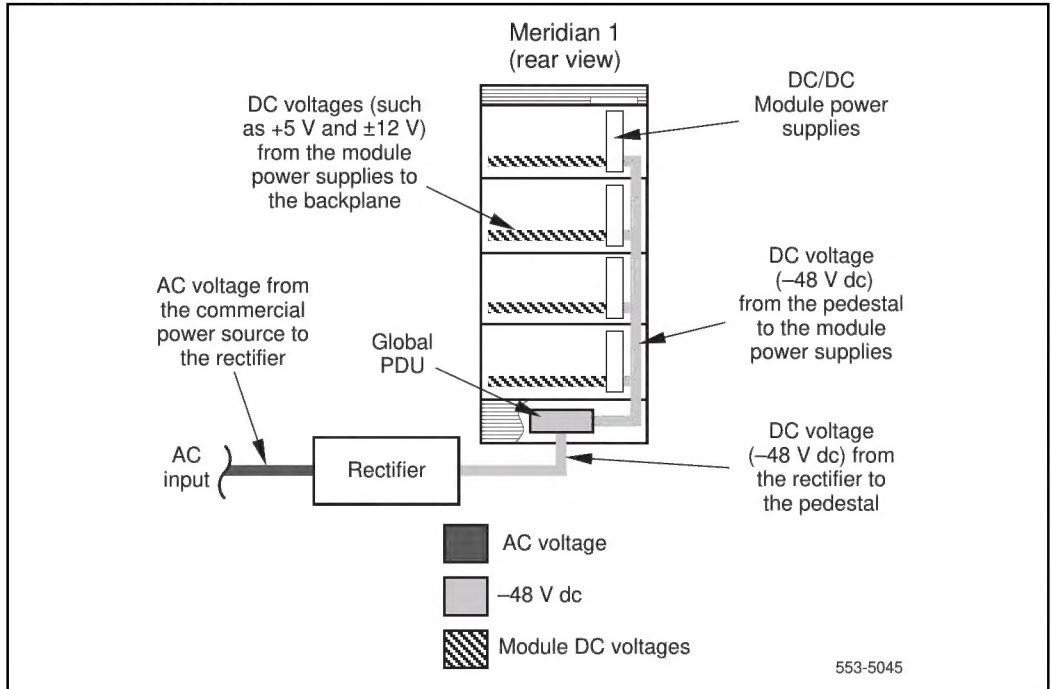
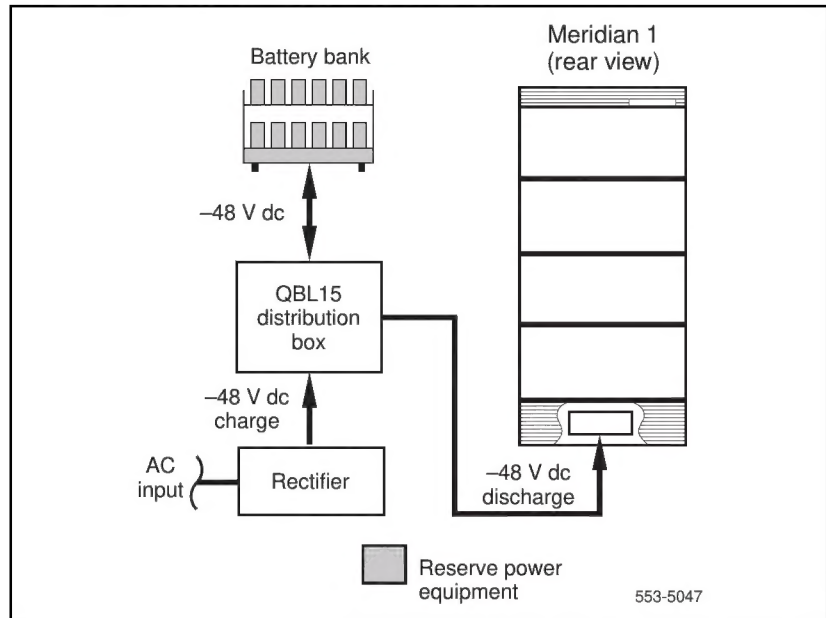


Figure 4
DC-powered system with reserve power



Grounding

Proper grounding is essential for trouble-free system operation and the safety of personnel.

Single Point Grounding

The single point grounding (SPG), otherwise known as the Star—IBN (Isolated Bonding Network), is the standard for the Meridian 1 systems.

The SPG of a system is the point at which an IBN is bonded to ground. Physically, the system SPG is usually implemented as a copper busbar. See [Figure 5](#).

Any of the following busbars can be used as system SPG:

- Building principal ground (BPG), typically in single floor buildings
- Floor ground bar (FGB), typically in multi-floor buildings
- Dedicated SPG bar bonded to the building grounding system
- A section of the battery return (BR) bar of the power plant.

The various subsystems (such as groups of frames or equipment) of an IBN system can be configured as individual SPG entities, connected in a star configuration to the system SPG (star IBN).

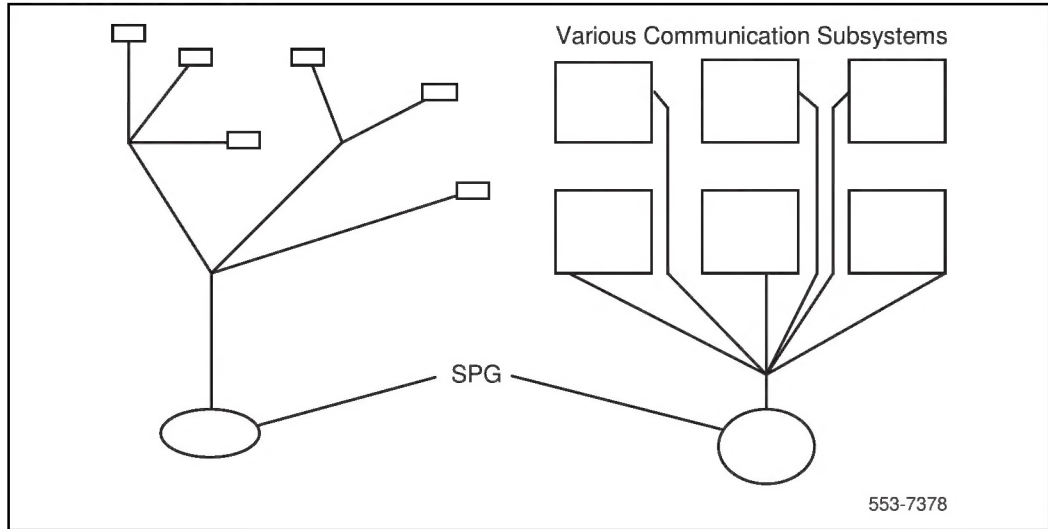
SPG requirements are divided into the following major categories:

- Safety
- Protection
- EMC
- Installation and Maintenance Concern
- Power

Safety

To ensure a safe working environment for trained company personnel, the customer premises grounding system must be able to dissipate surge energies (such as lightning strikes on the outside plant). In addition, the grounding system must be designed to ensure that fuses or breakers operate to disrupt any excessive current flow caused by a power fault.

Figure 5
Single point ground



Protection

A proper ground is essential to systems protecting equipment. This includes grounding for outside plant cable shields and protectors, as well as the grounds associated with framework, battery, and logic references.

EMC

Grounding must be considered at all times to ensure good Electromagnetic Compatibility (EMC), emission and susceptibility performance.

Installation and maintenance

If included as part of the initial electrical installation for the customer premises, a grounding system is cost effective to install and maintain. Adding a grounding system after the initial installation is complete can be difficult and costly.

Powering

Consider the powering options for the equipment, when planning the grounding system. Look at whether the equipment is backed up with batteries or an uninterruptible power supply (UPS). The grounding and powering of all equipment associated with the telecommunication system should be considered as one large system.

Types of ground

The Meridian 1 has several different grounds and signal returns that are generally referred to as grounds:

- Safety (personal hazard) ground
- Logic return
- Battery return (for DC systems)
- AC “green wire” ground

Safety ground

[Figures 6](#) through [9](#) illustrate examples of Meridian 1 power and ground connections in several AC system configurations.

If conduit is used to connect AC power from a service panel to the pedestal, it must contain an insulated ground wire (green) that is #6 AWG or larger size. If a cord-and-plug connection is used, a separate safety ground must be provided. The safety ground is required to reduce the risk of electric shock to personnel and avoid system malfunctions under these conditions:

- A telephone wire contacts AC current elsewhere in the building while the AC input cord is unplugged.
- Lightning transients when the cord is unplugged.
- Stray grounds during normal operation.

This safety ground, also known as frame ground or chassis ground, must be an insulated wire #6 AWG or larger, and must connect to both the pedestal safety ground lugs and the service panel ground bus. In all Meridian 1 systems, except for option 21A, one 30 A circuit is required for each column; for option 21A, one 20 A circuit is required. Isolation, as required by NEC 250-74 and 384-27 (exception 1), is preferred.

A single-point ground (SPG) is an isolated ground (IG) bus or AC equipment ground (ACEG) bus in the service panel or transformer. It may also be a separate external bus bar that connects at a single point to the service panel or transformer. [Figures 6](#) through [9](#) show an isolated ACEG as the single-point ground.

Depending on the distance between columns (and cabinets in upgraded systems) and the service panel, the safety ground wiring may be daisy-chained or run independently from each column (or each row) to the ACEG. [Figures 7](#) through [9](#) show safety ground wiring in daisy-chain configurations.

Figure 6
AC power—single-column distribution

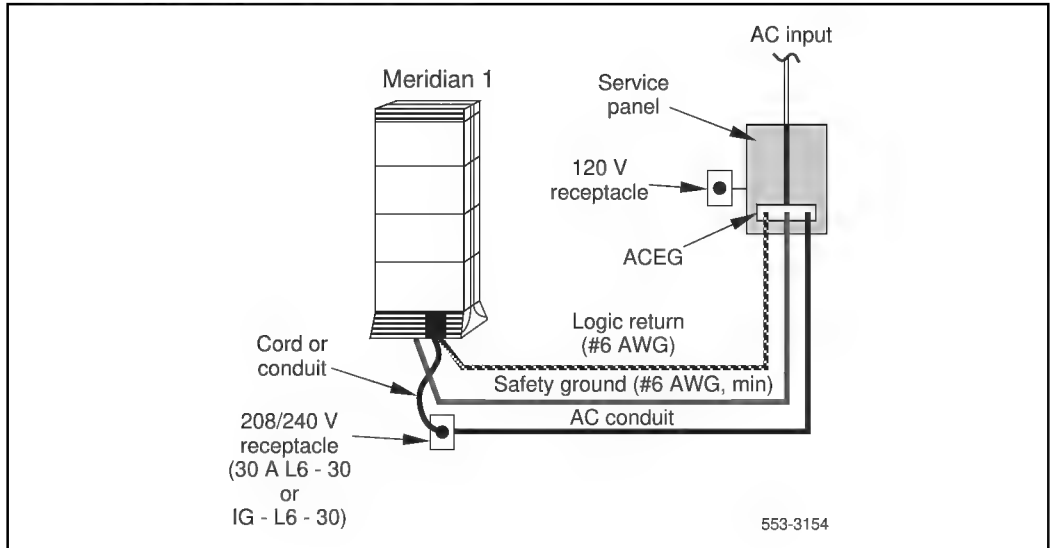


Figure 7
AC power—multiple-column distribution

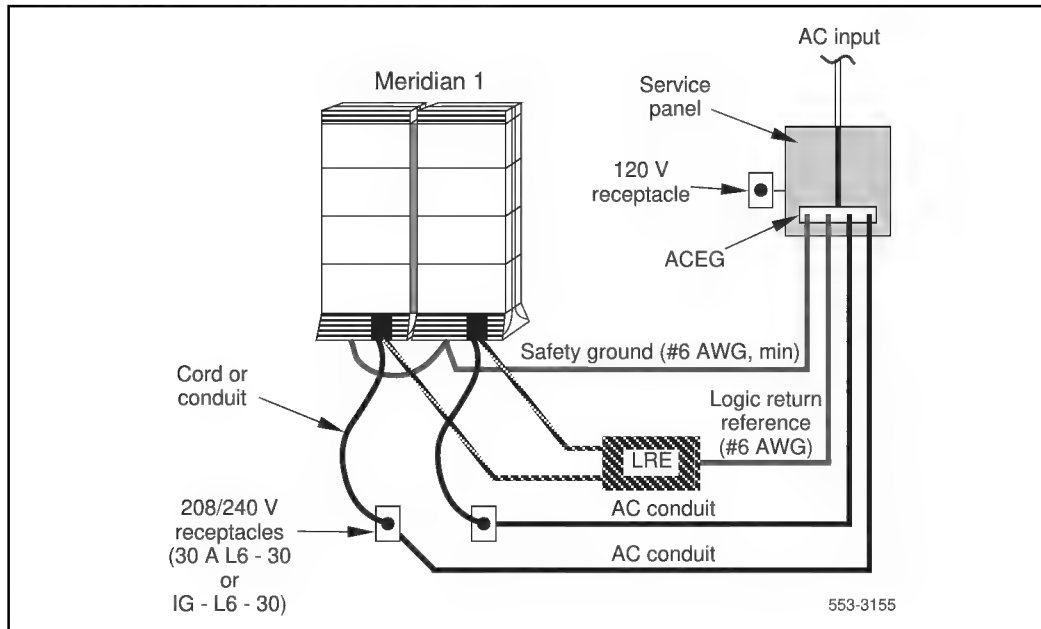


Figure 8
AC power—multiple-row distribution

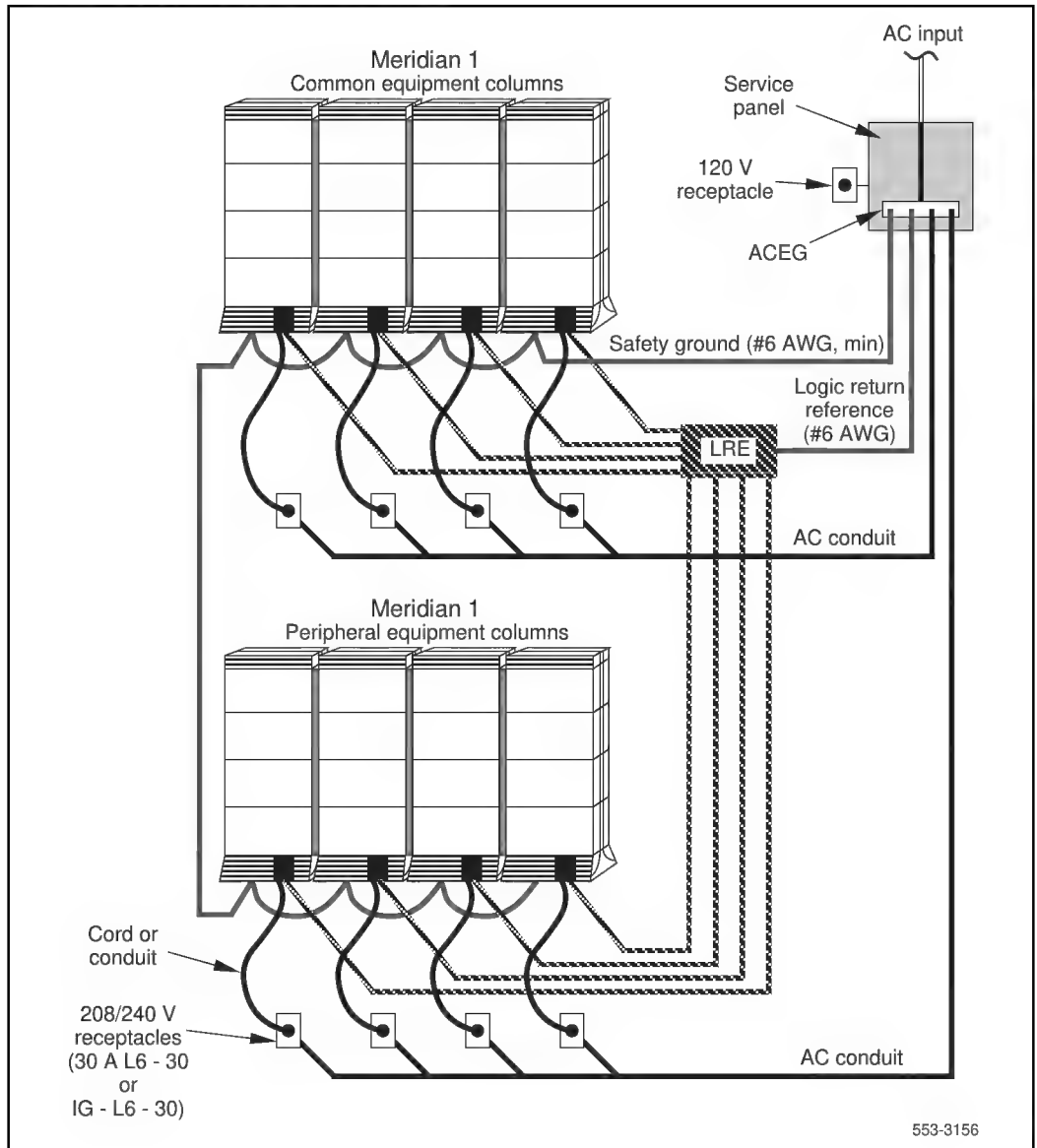
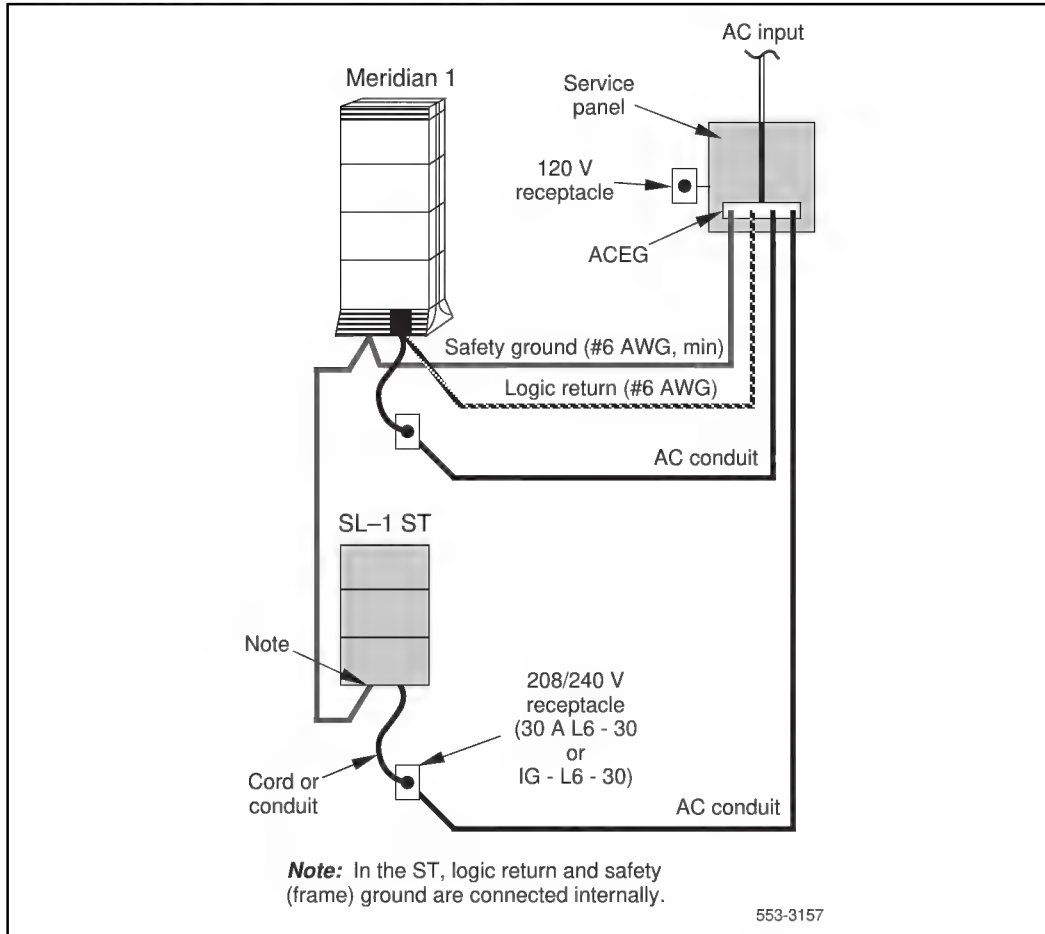


Figure 9
AC power—upgraded system distribution



To implement the single-point ground, follow these guidelines:

- All ground conductors must comply with local electrical codes and be terminated in a manner that is permanent, resulting in low impedance connections.
- All terminations should be readily accessible for inspection and maintenance.
- A grounding conductor must be continuous with no splices or junctions.
- The insulated grounding wire size must comply with the National Electric Code (NEC) Sections 250-94, 250-95, and 310-15.
- Conductors must be insulated against contact with foreign (non-AC) grounds.
- Grounding conductors must be no-load type and carry no current under normal operating conditions.
- The use of building steel as an integral part of the ground system is not recommended.

Logic return

A logic return equalizer (LRE) is a separate bus bar (such as an NT6D5303 or NT6D5304) used to join logic return wires at a common point. A #6 AWG conductor connects the LRE to the ACEG in the service panel. With multiple columns, the LRE is typically located in a nearby rack, in an overhead trough, or under a raised floor. The LRE must be insulated from the AC-grounded support structure. [Figures 7](#) through [9](#) show the use of an LRE in multi-column configurations.

The logic return equalizer is a consolidation point for all the logic return grounds. It is connected to the AC Equipment Ground (ACEG) which is located within the systems dedicated AC panel. The isolated ground bus within the dedicated AC service panel serves as the “system” SPG. The dedicated AC service panel should be supplied from the buildings principle ground source, usually a transformer which is located within the building. It is at this point that the neutral to ground bond is performed and the live, neutral and grounding conductors are supplied, all together within a single conduit, to the dedicated AC panel for the communication equipment. The dedicated AC panel should service all the communication equipment and any logically interconnected devices (such as modems, TTYs, multiplexers, etc.). This ensures that all equipment has the same ground reference.

The LRE must be insulated from the AC-grounded support structure. [Figures 7](#) through [9](#) show the use of an LRE in multi-column configurations.

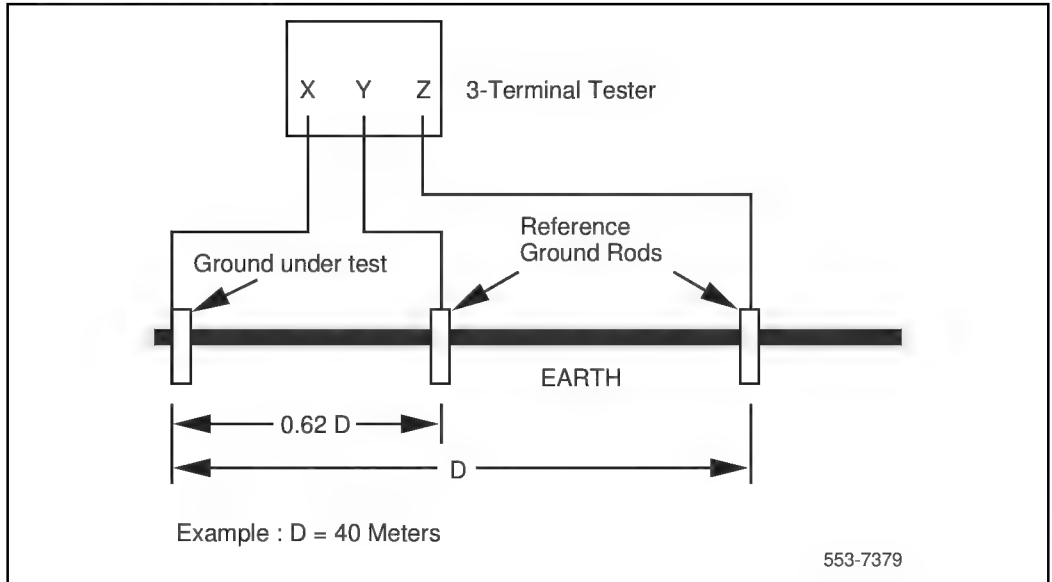
Identifying good grounds

The main ground consists of rods or plates and is considered a good ground when the resistance of the rods or plates to ground is as low as practical. A recognized industrial standard is 5 ohms.

Usually a visual inspection will suffice to ensure that the connection of the ground conductor to the main ground is soundly made. It is possible to verify the quality of the ground by using a three terminal tester. [Figure 10](#) outlines this procedure.

Refer to the three terminal tester manufacturers handbook for testing instructions.

Figure 10
Three terminal testing



Circuit protection

RS-232 port protection

RS-232 type interfaces are susceptible to induced lightning damage when hardwired lines are run building to building. As little as 25 volts can cause damage. Typically only pins 2 (send), 3 (receive) and 7 (signal ground) are connected end to end via twisted shielded pairs.

Although the RS-232 specification supports only 50 feet of operation, many applications successfully pass data at much longer distances. However, problems arise when different grounds are used at the two ends of the cable. Grounding at both ends will cause a ground loop current to flow in the shield due to the fact that each ground point will most likely be at a different potential. This current flow will induce a voltage onto the signal or data lines resulting in erroneous data or fault conditions.

To prevent the creation of a current loop, the shield must only be grounded at one end and in general this takes place at the system end. SDI ports must be connected to the I/O panel at the rear of the M1 switch. RS-232 cables should then be connected to the I/O panel. RS-232 cables should never be connected directly to the connector on the SDI pack.

A modem or isolator must be installed for all RS - 232 devices not connected to the Meridian 1 AC equipment panel ground.

Off Premises Line Protection

All voice and data lines which run externally from the building that contains the Meridian 1 must have proper line protection. The cable sheath must be connected to the SPG.

Power service panel

Power service panels must meet the following requirements or be modified when used for the Meridian 1:

- Panels should be located in the equipment room.
- No lights, air conditioners, heaters, generators, or motors may be connected to this service panel.

AC power systems

In an AC-powered system, no power components external to the Meridian 1 columns are required. AC systems perform a single conversion from the AC input voltage to the DC voltages required by circuit cards in each module. Optional reserve power is provided by an uninterruptible power supply (UPS) and batteries.

AC power input specifications

AC power supplies operate from a nominal input of 208 to 240 volts AC, single-phase. While the actual input range of the AC power supplies is 180–280 V, no restrapping the power supplies is required if the input line voltage is within 208–240 V.

AC-powered systems require one IG-L6-30 or L6-30 receptacle for each column within 2.4 m (8 ft) of the column's pedestal. Each column comes equipped with one 30 A cord and plug.

Note: Do not use ground fault circuit interrupt (GFCI) devices on Meridian 1 AC power circuits.

As an alternative to using the power cord and plug, AC input to the PDU may be wired directly. Use #10 AWG conductors routed through 1.9-cm (3/4-in.) conduit. Connect the conductors to the input terminals on the field wiring terminal block in the PDU for a 240 V AC input, as indicated in [Table 1](#).

Table 1
AC input connections

AC input conductor	Meridian 1 PDU terminal
Hot—Phase I	L1
Hot—Phase II	L2
Safety Ground	GND

All AC input power wiring must contain a separate safety ground conductor (green wire). Northern Telecom strongly recommends a dedicated AC supply that runs uninterrupted from the building primary source to a dedicated equipment room service panel.

Note: Follow all applicable electrical codes if the AC input is wired directly to the PDU.

If reserve power is used, install the UPS, along with its associated batteries (which may be internal or external to the unit), in series with the commercial power source. The Meridian 1 systems then plug into the UPS (see [Figure 2](#)). Consult the UPS manufacturer for requirements of the UPS power input receptacle.

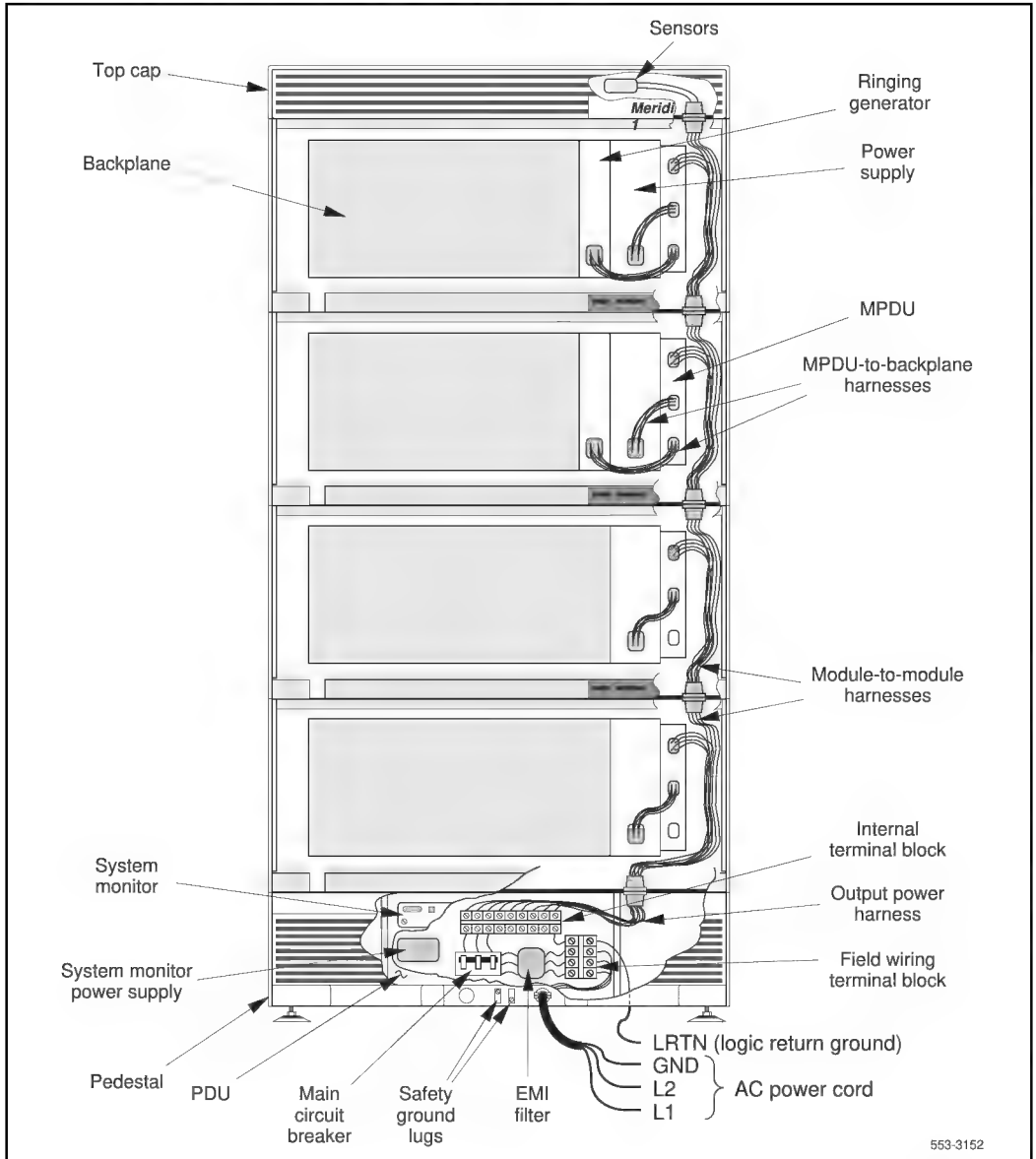
AC internal power distribution

[Figure 11](#) shows the elements of the AC internal power system. Components of the distribution system include the power distribution unit (PDU), module-to-module power harness, module power distribution unit (MPDU), MPDU-to-backplane power harness, and module power supply.

Input power wiring connects to the field wiring terminal block in the back of the PDU. The output power harness connects the field terminal block to the first module. The module-to-module harness distributes power to the MPDU in each successive module. The MPDU-to-backplane harness distribute power from the MPDU to the module power supply and ringing generator, if equipped. The module power supply converts the AC voltage to the DC voltages required by the circuit cards in the module.

Note: The NT8D11AC Common Equipment/Peripheral Equipment (CE/PE) Module does not require an MPDU; AC power is distributed directly from the PDU to the NT7D14 CE/PE Power Supply in this module.

Figure 11
AC internal power distribution (rear of the column)



Power distribution unit (PDU)

Located in the rear of the pedestal, the PDU serves several functions, but primarily it serves as a power distribution point for the entire column. The field wiring terminal block provides the connection point for the AC input wiring. The electromagnetic interference (EMI) filter (required for regulatory compliance) keeps EMI from radiating outside the confines of the column. The circuit breaker, which is the main circuit breaker for all modules in the column, protects the column if there is a current or thermal overload. The internal terminal block provides a distribution point for power output wiring to the modules. The power/signal harness (not shown in [Figure 11](#)) provides power and signal interconnections for the blower unit and system monitor. The system monitor power supply provides +5 V power to the system monitor even when the main circuit breaker is off. The output power harness relays power from the pedestal to the module(s) above it.

Note: The system monitor is housed in the PDU. The system monitor is powered by a small AC power supply, which is not connected to the circuit breaker for the column.

Intermodule harnesses

Several power harnesses conduct the input voltage throughout the column (see [Figure 11](#)). The module-to-module harness connects to the MPDU in each module and to the module above. The MPDU-to-backplane harness distributes power from the MPDU to the module power supply and ringing generator, if equipped, through backplane power connectors.

Module power distribution unit (MPDU)

An MPDU provides the circuit breakers that provide current protection at the module level, so only a faulty module is shut down while others remain functional. Table 2 lists the three MPDUs, power supplies, and modules with which each is compatible.

Table 2
MPDU, power supply, and module compatibility

MPDU	Power supply	Module
NT8D56AA	NT8D29CE (for options 51/51C/61/61C/71/ 81/81C)	NT5D21 Core/Network NT8D34AA CPU NT6D39AA CPU/Network NT8D35AA Network NT9D11AA Core/Network
NT8D56AC (replaces NT8D56AB)	NT7D14CE/PE (for options 21/21A/21E)	NT8D11AC CE/PE NT8D47AA RPE
NT8D57AA	NT8D06PE NT8D21 (ring generator)	NT8D37AA IPE NT8D13AA PE

Module power supplies

In each module, input voltage is carried through the backplane harness to the module power supply where it is converted to the voltages required by the circuit cards in the module. [Table 2](#) lists the compatibility between module, MPDUs, and each power supply.

[Table 3](#) lists the output voltages and currents for AC module power supplies.

Table 3
Output voltages and currents for AC power supplies

Module	Output volts (V ac)	Output amperes	Output volts/ volt-amperes (V ac / VA) (Note)	Output frequency (Hz)
NT7D14 CE/PE Power Supply	+5.1	60.00	86/5	20
	-8.5	2.50		
	+12.0	1.00		
	-12.0	0.75		
	+15.0	10.00		
	-15.0	10.00		
	-48.0	4.75		
	-150.0	0.13		
	+86.0	0.103		
NT8D06 PE Power Supply	+5.1	28.00	—	—
	+8.5	4.00		
	+10.0	0.50		
	-10.0	0.50		
	+15.0	17.00		
	-15.0	15.00		
NT8D21 Ringing Generator	-48.0	7.70	70/8 80/8 86/8	25/50 25/50 20/25
	-150.0	0.20		
	+70.0	0.127		
	+80.0	0.111		
NT8D29 CE Power Supply	+86.0	0.103	—	—
	+5.1	60.00		
	+12.0	2.50		
	-12.0	1.00		

DC power systems

The Meridian 1 DC-powered systems require an external DC power plant consisting of rectifiers (also called *chargers* or *AC/DC converters*) and power distribution and control equipment. This equipment continuously charges a bank of batteries (if equipped) and distributes the DC power to each column.

DC-powered systems require two stages of power conversion. The rectifiers convert the input AC voltage into a nominal DC voltage that is adjustable to correspond to the normal float voltage of a battery bank. This DC voltage is distributed throughout the system to each of the modules, where the module power supplies convert this voltage to the voltages required by the circuit cards in the module.

The DC power system must be able to provide the required current and operate within the specifications listed in [Table 4](#). For additional battery voltage requirements, see [Table 8, “Battery requirements,” on page 49](#).

Table 4
Input specifications—DC power system

Input	Pedestal	Battery
Maximum range	–40 to –56.5 V	–42 to –56.5 V
Expected nominal (24 stationary cells)	—	–52.08 V
Expected nominal (23 sealed cells)	—	–51.75 V
Expected nominal (24 sealed cells)	—	–54.00 V
Noise (max C msg)	—	22 dBrnC (See Note)
Note: Without battery, C msg (max) is 32 dBrnC.		

Input power specifications

Meridian 1 DC-power plants require one separate AC input per rectifier, within 1.8 m (6 ft) of the rectifier. The total requirements for commercial AC power input is determined by the number and type of rectifiers used.

Note 1: Do not confuse the output rating of the rectifiers in DC amps with input requirements in AC amps.

Note 2: NT7D10AA and NT7D10DA PDUs with the NT6D53 junction box can be used to distribute the power to Meridian 1 when the power source is at a distance from Meridian 1. Refer to NT6D53 Junction Box and Table A-7 in *Meridian 1 system installation procedures* (553-3001-210) for junction box implementation and power and ground wire gauges determination for various distances of power source to Meridian 1. Also, refer to *Wire size calculation* in this manual for determining the required wire size based on the current required and the distance between the power source and Meridian 1. A junction box may be used with the NT7D67CB PDU, but it is not required.

Internal power distribution

Power distribution in the DC-powered Meridian 1 system (see [Figure 12](#)) consists of the NT7D67CB PDU, the module-to-module power harness, the module-to-backplane power harness, and the module power supply.

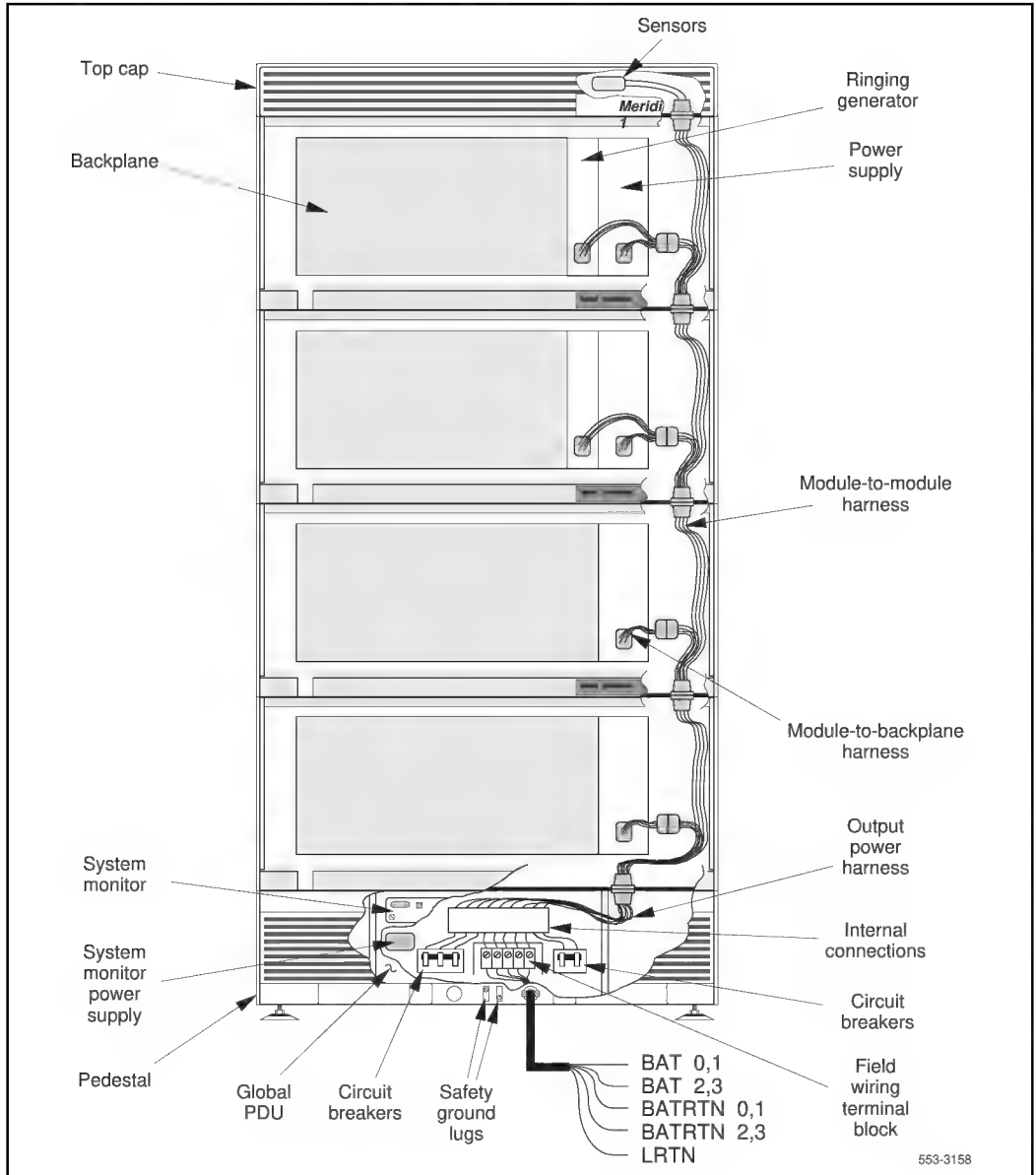
DC power cables connect to the field wiring terminal block where an output power harness carries the input voltage to the first module.

Module-to-module harnesses distribute DC voltage to successive modules. Module-to-backplane harnesses distribute DC voltage to the module power supply and ringing generator, if equipped. In each module, the module power supply converts the DC input voltage to the several DC voltages required by the circuit cards in the module.

Power distribution unit

The PDU, located in the rear of each pedestal, distributes power to the entire column.

Figure 12
DC internal power distribution (rear of the column)



Note: A “global” PDU replaces the one-piece NT7D10AA (North American) and NT7D10DA (European) PDUs. The global PDU consists of an upper NT7D10CA System Monitor/Power Supply Assembly and a lower NT7D67CB Filter/Power Distribution Unit Assembly. Throughout this document, the global PDU is referred to as the “NT7D67CB PDU.” Both NT7D10 (vintage AA or DA) and NT7D67 PDUs may be used in the same system.

The PDU provides a common distribution point for the input voltage. The output power harness connects the pedestal to the first module. Individual wiring harnesses carry the current to each successive module. The power/signal harness (not shown in [Figure 12](#)) provides power and signal connections between the blower unit and system monitor.

In the event of a current overload, one of four circuit breakers located in the PDU protects each module. A fifth circuit breaker provides protection for the whole column in the event of a thermal overload. The system monitor power supply provides +5 V power to the system monitor (even when the PDU circuit breakers are off).

Note: The system monitor is housed in the NT7D10CA System Monitor/Power Supply Assembly. The system monitor is powered by a small +5 V power supply, which is not connected to the column circuit breakers.

Intermodule harnesses

Several power harnesses conduct the input voltage throughout the column. The module-to-module harness consists of the module connector, which distributes power to the module or modules above it, and the backplane connector, which distributes power through the module-to-backplane harness to each module power supply.

Module power supplies

In each module, –48 V is received through the module-to-backplane distribution harness and converted by the module power supply to the necessary voltages for the individual module. There is an on/off switch on each power supply for safe operation and easy maintenance.

There are five DC module power supplies:

- The NT5K12AA Power Supply (EPEPS) (International) provides all power for the Enhanced Existing Peripheral Equipment (EEPE) module and includes the ringing generator.

Note: The NT5K12BA is not equipped with –120 or –150 V dc message waiting supply.

- The NT6D40 PE Power Supply provides power to circuit cards and talk battery to lines and trunks.
- The NT6D41 CE Power Supply provides power to circuit cards.
- The NT6D42 Ringing Generator (replaces NT7D03) provides –150 or –100 V dc message waiting lamp voltages for 500/2500 telephones. It can provide ringing power to 48 ringers simultaneously.
- The NT6D43 CE/PE Power Supply (replaces NT7D04) provides power to circuit cards, talk battery to lines and trunks, and ringing and message waiting lamp voltages for 500/2500 telephones.

Table 5
MPDU, power supply, and module compatibility

Power supply	Module
NT6D40PE	NT8D13DC PE NT8D37DC IPE
NT6D41CE	NT6D39DC CPU/Network NT5D21 Core/Network NT6D60BA Core NT8D34DC CPU NT8D35DC Network NT9D11DC Core/Network
NT6D42 ring generator (replaces NT7D03)	NT8D13DC PE NT8D37DC IPE
NT6D43 (replaces NT7D04)	NT8D11DC CE/PE NT8D47DC RPE

[Table 2, “MPDU, power supply, and module compatibility,” on page 27](#) lists power supply compatibility and [Table 6](#) lists the output voltage and currents for DC power supplies.

Table 6
Output voltages and currents for DC power supplies (Part 1 of 2)

Power supply	Output volts	Output amperes	Output volts/ volt-amperes (V ac / VA) (Note)	Output frequency (Hz)
NT5K12 EPE Power Supply (International)	+5.0	0.75	70/8.0	20/25/50
	+6.0	4.00	75/8.0	20/25/50
	−6.0	4.00	80/8.0	20/25/50
	+10.0	0.80	86/8.0	20/25/50
	−10.0	0.80		
	+15.0	7.20		
	−15.0	7.20		
	−48.0	5.00		
	−120.0	0.20		
	−150.0	0.20		
NT6D40 PE Power Supply	+5.1	28.00	—	—
	+8.5	4.00		
	+10.0	0.50		
	−10.0	0.50		
	+15.0	17.00		
	−15.0	15.00		
	−48.0	7.70		

Table 6
Output voltages and currents for DC power supplies (Part 2 of 2)

Power supply	Output volts	Output amperes	Output volts/ volt-amperes (V ac / VA) (Note)	Output frequency (Hz)
NT6D41 CE Power Supply	+5.1	60.00	—	—
	+12.0	3.50		
	-12.0	1.00		
NT6D42 Ringing Generator	-100.0	0.20	70/16	20/25/50
	-150.0	0.20	75/16	20/25/50
	70.0	0.127	80/16	20/25/50
	80.0	0.111	86/16	
	86.0	0.103		
NT6D43 CE/PE Power Supply	+5.1	60.00	70/16	20/25/50
	+8.5	2.50	75/16	20/25/50
	+12.0	1.00	80/16	20/25/50
	-12.0	0.75	86/16	
	+15.0	10.00		
	-15.0	10.00		
	-48.0	4.95		
	-120.0	0.20		
	-150.0	0.20		

External power distribution

A variety of rectifiers and distribution equipment can be used to supply external DC power. Existing customer equipment can be used or a system that Northern Telecom either supplies or recommends. In any case, equipment for rectification and distribution is required, while reserve batteries are optional.

NT0R72 Switched Mode Rectifier

The NT0R72 Switched Mode Rectifier is used with system options 21, 21E, 51, 51C, 61, and 61C. This rectifier converts a range of input voltages (from 176 to 280V) to -48 V dc up to a maximum output of 25 A. NT0R72 rectifiers are used to replace defective NT6D52 rectifiers or to expend the power capacity of an existing NT7D12 Rectifier Rack Assembly.

The rectifier connects to the Meridian 1 system through the QBL15 Power Distribution Box. Generally, one rectifier is needed for every two fully loaded modules. The exact quantity required depends on the system configuration and power requirements.

Up to three NT0R72 rectifiers can be installed in the NT7D12 Rectifier Rack Assembly. Up to two rectifier racks can be used for each system. This provides a total of six rectifiers (see [Figure 13](#)). Each rectifier is mounted in the rack using a NT7D1201 Rectifier Support/Air Baffle, which consists of a set of rectifier support brackets and a heat baffle plate. One kit is required for each rectifier.

The NT7D1204 Mounting Hardware kit is used to mount an NT0R72 rectifier on to the NT7D12 Rack.

Each rectifier comes equipped with a QCAD274 Rectifier Cord and requires one L6-20 locking receptacle for each rectifier.

NT6D52 Switched Mode Rectifier

The NT6D52 Switched Mode Rectifier is used with system options 21, 21E, 51, and 61. This rectifier converts a range of input voltages (from 180 to 250V) to –48 V dc up to a maximum output of 30 A.

Note: This rectifier is discontinued and is superseded by the NT0R72 Rectifier for expansion of existing NT7D12 Rectifier Rack Assemblies power capacity or for replacement of defective NT6D52 Rectifiers.

The rectifier connects to the Meridian 1 system through the QBL15 Power Distribution Box. Generally, one rectifier is needed for every two fully loaded modules. The exact quantity required depends on the system configuration and power requirements.

Up to three NT6D52 rectifiers can be installed in the NT7D12 Rectifier Rack Assembly. Up to two racks can be used per system housing a total of six rectifiers. Each rectifier is mounted in the rack using a NT7D1201 Rectifier Baffle/Mounting Kit which consists of a set of rectifier support brackets and a heat baffle plate. One kit is required for each rectifier.

Each rectifier comes equipped with a 20 A cord and plug and requires one L6-20 locking receptacle per rectifier.

Note: To ensure safe operation of the rectifiers, the input voltage limits of 180 to 250 V ac must not be exceeded. The tolerance of most commercial utility AC power is ± 10 percent. Since $240\text{V} + 10\% = 264\text{ V}$, which may damage the rectifier, this input voltage is unacceptable. If only 240 V ac service is available, a 240 to 208 V ac step-down transformer or other voltage converter must be used to ensure that the 250 V limit is not exceeded.

QBL15 Power Distribution Box

The QBL15 (see [Figure 14](#)) is a common connection point for the rectifier output and battery backup power, and common distribution point for DC power and power monitor signals. Up to three NT0R72 rectifiers can be connected to a QBL15, as can backup battery output. Two QBL15s must be used to support two NT7D12 Rectifier Rack Assemblies.

The QBL15 can also be used to connect NT0RL72 or old NT6D52 rectifiers with existing QRF12 or NT0R71 rectifiers in a load sharing arrangement (for more information on load sharing, see “Powering upgraded systems from existing rectifiers” on page 95 in the “Component power consumption” chapter).

Also built into the QBL15 are a QPC188 battery monitor card, test points, and fused sense leads for each rectifier. A maximum of two QBL15 distribution boxes can be used per system.

For installation procedures, see *Meridian 1 system installation procedures* (553-3001-210).

Figure 13
NT7D12 Rectifier Rack Assembly with three NT0R72 rectifiers

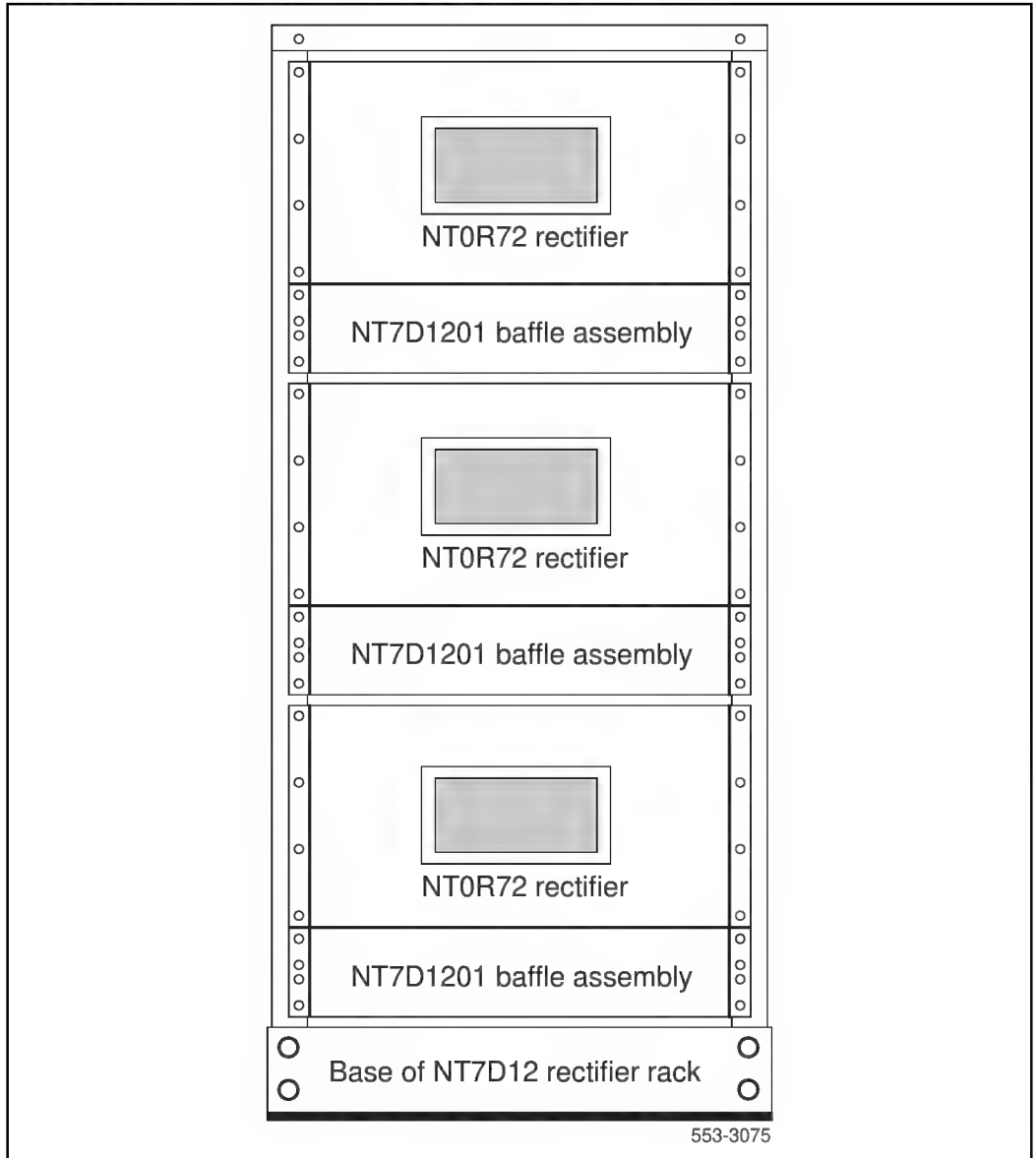
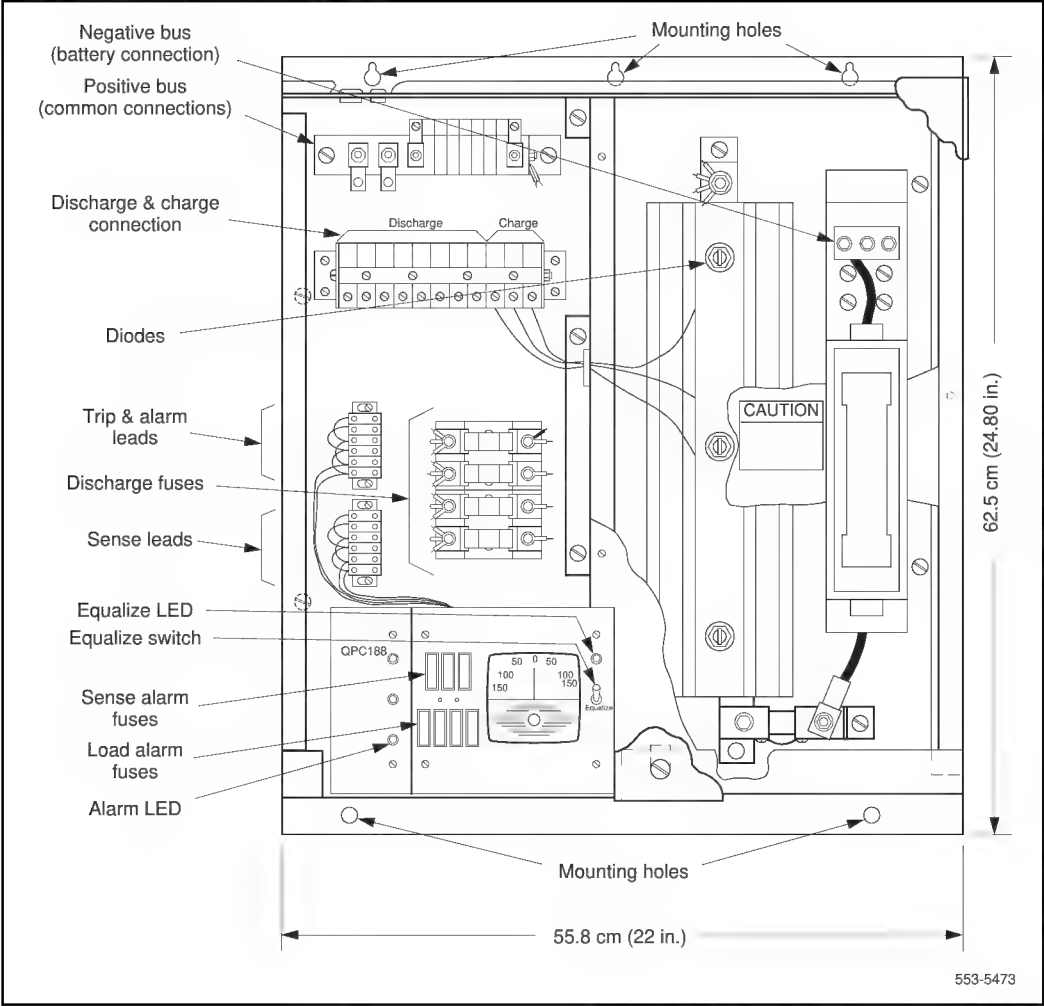


Figure 14
QBL15 Power Distribution Box



Reserve power

Reserve power is available for both AC and DC systems. When selecting reserve power equipment, consider:

- Future system growth
- Maximum time back-up power is required
- Existing power system capacity
- Space and thermal environment (air conditioning)
- Other equipment, such as lights and alarm systems

Reserve power for AC systems is provided by uninterruptible power supplies (UPS), installed in a series with the commercial power source. A UPS generally consists of a combination battery charger (AC/DC converter) and inverter (DC/AC converter), along with associated batteries. The batteries may be internal or external to the UPS. A UPS is not a standby power source, but an on-line unit with no output interruption when the AC power is interrupted.

DC systems use the traditional telecommunications powering method: external rectifiers (AC/DC converters) continuously charge a bank of batteries while the system power “floats” in parallel on the battery voltage.

AC reserve power

There are a number of UPS vendors and systems available. Factors to consider when choosing a UPS include:

- Input voltage and frequency range
- Output voltage and current capacity
- Number and type of output receptacles
- Regulatory and safety agency approvals
- Efficiency and performance considerations

- Alarm and status indications
- Battery recharge time
- Maximum time backup power is required
- Existing batteries or other power equipment available at the site
- Future system growth

UPS sizing

To determine UPS sizing, first calculate the total power requirements of the column (or columns) supported by the UPS, as described later in the chapter “Component power consumption” on page 87. Convert the real power in watts (W) to complex or “apparent” power in volt-amperes (VA) by dividing the real power by the typical system power factor of 0.6. Then size the UPS in terms of its rating in VA (or kVA). For AC-powered Meridian 1 systems, Autoquote calculates the system power consumption in both watts and volt-amperes.

$$VA = \frac{W}{0.6}$$

To determine the sizing and provisioning of UPS batteries, follow the instructions provided by the UPS manufacturer. A general approach, however, is to take the total system power in watts, divide by the UPS inverter efficiency, and convert to battery current drain by dividing by the nominal discharge voltage of the battery string. Then multiply the battery current drain by the time needed for the reserve power to operate to determine the battery requirements in ampere-hours (A-hrs).

$$Ahr = \left(\frac{W_{total}}{V_{dischg}} \right) T_{reserve}$$

UPS interfacing

A UPS must meet the following requirements in order to be used with Meridian 1 systems:

- The UPS specifications must meet the commercial power specifications of the Meridian 1:
 - Nominal output voltage range of 208–240 V AC, with a total input range of 180–250 V AC
 - Nominal frequency of 50–60 Hz, with a total range of 47–63 Hz
 - Total harmonic distortion (THD) of 5%, with 3% on any single harmonic, of the AC sine wave
- The UPS must be able to handle a non-linear loads (the AC module power supplies are a switched-mode design) and have a current crest ratio of 3.0 or greater.
- The UPS must be UL listed and certified under FCC Part 15, Subpart J as a Class A device.
- The UPS must have a 30 A, 250 V locking power receptacle (L6-30) for each Meridian 1 column to be powered.
- The UPS must meet ANSI standard C62.41 and IEEE standard 587-1980, class A and B, for transient surge suppression.

Note: It is convenient for the UPS to have one or more 120 V power outlets (5-15R) for auxiliary devices that must have backup power, such as the power fail transfer unit power supply.

UPS installation

When installing a UPS, follow the vendor's instructions carefully.

Note: UPS installation can be complex. Northern Telecom recommends taking advantage of vendor training programs.

It is recommended that a bypass switch be installed during the initial UPS wiring (if the switch function is not inherently a part of the UPS itself). The UPS bypass switch allows the Meridian 1 to run directly from the commercial power source while the UPS is taken off-line during installation, service, or battery maintenance.

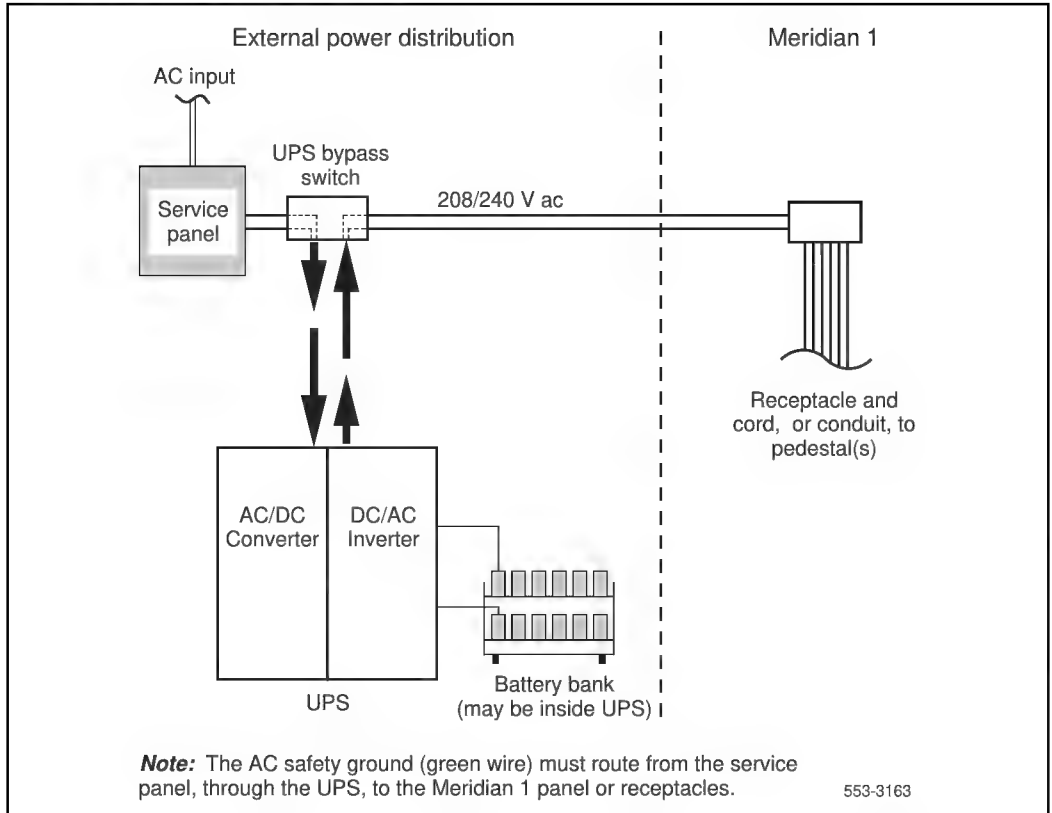
CAUTION

Equipment damage

Take care when connecting battery cables to the UPS. Connecting battery cables backward can result in severe damage to the UPS.

Figure 15 shows a general block diagram of a UPS installation and associated wiring.

Figure 15
AC reserve power configuration



Power conditioning

The term “power conditioner” refers to a wide variety of power protection or power quality improvement devices, such as low-pass filters, surge arrestors, line voltage regulators, and isolation transformers. Most of these devices can help prevent power line spikes and surges, and some isolation transformers can provide good noise rejection.

Although most power conditioning devices do not provide energy storage for undervoltage conditions, they can help prevent surges and other overvoltage conditions that can cause permanent damage to equipment.

When choosing UPS protection and power conditioning equipment, remember that over 90 percent of power disturbances in the U.S. are undervoltage conditions such as sags and outages. When there are U.S. power disturbances:

- 87% are power sags; 90% of these last 0.53 seconds or less
- 7.4% are impulses or spikes lasting less than 100 microseconds
- 4.7% are longer-term power failure; 90% of these last 4.2 hours or less, 75% last 40 minutes or less, and 50% last 38 seconds or less
- 0.7% are surges lasting more than 100 microseconds

Low voltage transients occur most frequently and may cause temporary loss of operation. High voltage transients occur much less often, but can cause damage to equipment as well as loss of operation.

Carefully consider the type of power line protection needed for the installation under consideration. A power conditioner can help provide overvoltage protection, but a UPS can (usually at a higher price) provide both overvoltage and undervoltage protection.

Alarm monitoring

Northern Telecom offers a system monitor to UPS interface cable for each of the product lines that have been tested for Meridian 1 compatibility. The system monitor interface is not supported for other vendors. [Table 7](#) lists the UPS-to-system monitor alarm cables that are available. UPS systems are not offered by, or available through Northern Telecom, but can be purchased directly from vendors or through authorized distributors.

Table 7
UPS-to-system monitor alarm cables

UPS vendor	Cable part number	Quantity
Alpha Technologies	NT8D46AU	one per UPS
Best Power Technology	NT8D46AJ	one per UPS
Exide Electronics	NT8D46AQ	one per UPS

The alarm interface consists of an “Inverter On” signal to indicate that the commercial power is interrupted and the UPS alone is supplying power to the system, and a “Summary Alarm” signal to indicate a fault or alarm condition at the UPS.

DC reserve power

Reserve power for DC systems is provided by adding batteries to the external power distribution system. Calculate reserve battery capacity as shown in [“UPS sizing” on page 42](#). This determines the total ampere-hour requirements of the batteries (see also “Component power consumption” on page 87).

To comply with safety requirements, read and fully understand the following documents before working with any battery systems:

- OSHA “Material Safety Data Sheet” that must be posted to meet OSHA requirements. This document outlines safe reserve battery handling procedures.
- National Electric Code 645-10. This document outlines requirements that call for the installation of AC- and DC-power kill switches to battery systems in certain environments.

Current requirements

The DC current required for battery reserves is based on the total system power requirement. For new installations you can determine power and battery requirements from data provided by Northern Telecom. For existing installations, see “Component power consumption” on page 87 for information on calculating current required for battery reserves.

Batteries

The reserve battery capacity required depends on the system line size (load), the time the reserve supply must last in the event of a power failure, and the battery end voltage. [Table 8](#) gives guidelines for reserve battery float and equalization voltages. These voltages must never be more negative than -56.5 V .

Table 8
Battery requirements

Battery configuration	Float voltage (V)		Equalize voltage (V)	
	Cell	Bank	Cell	Bank
24 stationary cells	-2.17	-52.08	-2.25	-54.00
23 sealed cells	-2.25	-51.75	-2.35	-54.05
24 sealed cells	-2.25	-54.00	-2.35	-56.40

Lead-calcium/absolyte batteries

Battery package provisioning is based on the number of Amp-hours required. Since battery package Amp-hour ratings are generally given at an eight hour discharge rate, adjustment factors are required to determine the required battery package. [Table 9](#) lists adjustment factors for lead-calcium and absolyte batteries. These factors are based on the discharge rates of the respective battery types from a specific supplier. Discharge characteristics may vary by manufacturer.

Table 9
Adjustment factors for lead-calcium and absolyte batteries

Reserve Hours	Lead Calcium Factor	(Sealed) Absolyte Factor
1	3.0	1.8
2	4.0	3.1
3	5.0	4.2
4	5.9	5.2
5	6.9	6.2
6	7.7	7.1
7	8.5	7.8
8	9.3	8.5
9	10.1	9.4
10	10.9	10.2
Note: If a system requires more than 10 hours of backup, the factor is linear. For example, if 15 hours are required, the factor is 15.		

Calculate battery requirement using this formula:

$$\text{Ahr} = I_L \times F_{\text{adj}}$$

where

Ahr= battery requirement in amp-hours

I_L = system load, in amps

F_{adj} = appropriate adjustment factor from [Table 9](#)

When using lead-calcium or sealed batteries, calculate battery recharge time using this formula:

$$T = \frac{\text{Ahr} \times 1.15}{I_{\text{RO}} - I_L}$$

where

T = battery recharge time

Ahr= battery capacity in amp-hours

I_L = total system load, in amps

I_{RO} = total rectifier output, in amps

Other battery considerations are:

- Not all sealed cells require equalization, but equalization voltage can be used for fast charging. Use a battery end voltage of 44 V when choosing battery banks.
- Use these electrical noise limitations for a battery bank:
 - 20 mV rms maximum ripple
 - 32 dBrnC maximum noise
- CEMF cells are not recommended because the noise they generate is unacceptable.

